

1 **ABSTRACT**

2 A video encoding system and method utilizes a three-dimensional (3-D)
3 wavelet transform and entropy coding that utilize motion information in a way to
4 reduce the sensitivity to motion. In one implementation, the coding process
5 initially estimates motion trajectories of pixels in a video object from frame to
6 frame in a video sequence to account for motion of the video object throughout the
7 frames. After motion estimation, a 3-D wavelet transform is applied in two parts.
8 First, a temporal 1-D wavelet transform is applied to the corresponding pixels
9 along the motion trajectories in a time direction. The temporal wavelet transform
10 produces decomposed frames of temporal wavelet transforms, where the spatial
11 correlation within each frame is well preserved. Second, a spatial 2-D wavelet
12 transform is applied to all frames containing the temporal wavelet coefficients.
13 The wavelet transforms produce coefficients within different sub-bands. The
14 process then codes wavelet coefficients. In particular, the coefficients are assigned
15 various contexts based on the significance of neighboring samples in previous,
16 current, and next frame, thereby taking advantage of any motion information
17 between frames. The wavelet coefficients are coded independently for each sub-
18 band to permit easy separation at a decoder, making resolution scalability and
19 temporal scalability natural and easy. During the coding, bits are allocated among
20 sub-bands according to a technique that optimizes rate-distortion characteristics.
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